Remarks/Arguments

A. Status of the Claims

Claims 22-67 were pending at the time of the Office Action. Claims 22, 30, 35, 40, 47, 53, 56, and 61 have been amended. Non-limiting support for claims 22 and 47 can be found throughout the specification and claims as originally filed. *See, e.g.*, specification at page 4, line 17. Non-limiting support for the amendments to claims 30 and 53 can be found throughout the specification and claims as originally filed. *See, e.g.*, specification at page 5, lines 19-21.

Claims 22-67 are pending.

B. Claim Objections

Claim 30 is objected to for the phrase "a wavelength of 630 nm." Current claim 30 has recites "a wavelength of 632.8 nm." Applicant requests that the objection be withdrawn.

C. The Indefiniteness Rejections Are Moot

Claims 35 and 56 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. It is asserted that the phrase "higher layer" is indefinite. Applicant respectfully disagrees. However, in an effort to further the prosecution and secure prompt allowance, claims 35 and 56 currently recite a method "wherein the uppermost layer of the anti-reflection coating is a low index layer made of said thin layer coated with said silica and/or metal oxide protective layer." From this it is clear that the external or uppermost layer of the anti-reflection coating is a bilayer comprising the SiO_xF_y layer coated with the protective layer.

Claims 40 and 61 are also rejected as indefinite. In particular, it is asserted that the phrase "HI layer" is unclear. These claims currently recite a method "wherein the thickness of said HI layer is from 120 to 150 nm." From this it is clear that the HI layer referred to is the HI layer closest to the SiO_xF_y layer (see claims 39 and 60, respectively).

In view of the above, Applicant requests that the indefiniteness rejections be withdrawn.

D. The Anticipation Rejection Is Overcome

Claims 22-25, 28-30, 33, and 47-54 are rejected under 35 U.S.C. § 102(b) as being anticipated by Lee (EP 0975017) referred to as "EP." It is alleged that the '071 patent discloses a fluorine doped silicon layer (FSG) on which is disposed a dielectric silicon dioxide layer cap layer. Action at page 3. The silica layer is deposited by PECVD and HDP type CVD. *Id.*

Applicant respectfully disagrees. In order to maintain the anticipation rejection, every element of Applicant's claimed invention must be "identically shown" in the EP reference. *See In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990) ("For a prior art reference to anticipate in terms of 35 U.S.C. § 102, every element of the claimed invention must be identically shown in a single reference.").

As discussed in the following subsections, EP fails to disclose Applicant's claimed "method for obtaining a stabilized SiO_xF_y fluorine-doped silica thin layer, comprising forming on a SiO_xF_y silicon oxyfluoride layer, a SiO_2 silica and/or a metal oxide protective layer through ion beam-assisted vapor phase deposition . . . wherein the beam of positive ions is formed with an ion gun." Claim 22; *see also* claim 47.

1. Scope and Content of EP

EP appears to concern a semiconductor device and method of forming a patterned conductive layer on a semiconductor substrate. EP at Abstract. The substrate is coated with a conductive layer, a dielectric silicone dioxide liner on the conductive layer, a fluorinated silicate glass (FSG) layer on the dielectric liner, a dielectric silicon dioxide cap layer on the FSG layer, and a silicon oxynitride layer on the dielectric cap layer. *Id.* at paragraph [0030]. A photoresist layer is provided on the silicon oxynitride layer. *Id.*

Importantly, EP explains that the silicon dioxide cap layer (which is deposited on the FSG layer) is deposited by plasma enhanced chemical vapor deposition (PECVD). *Id.* at

paragraph [0059]. The FSG layer (which is deposited on the dielectric liner can also be effected by high-density plasma (HDP) type CVD. *Id.* A person of ordinary skill in the art would understand that PECVD is a process that involves the deposition of thin films from a gas state (vapor) to a solid state onto a substrate. The gas state is a plasma vapor phase.

Further, EP suggests that protecting FSG layers is classically performed by deposition onto this layer of a silica layer. However, this solution is unsatisfactory according to EP, since fluorinated products diffuse well into silicon dioxide films, with a diffusion length that can be higher than several thousand angstroms (paragraphs [0016] and [0039]). EP also explains that the FSG layer is typically deposited onto a semi-conductor substrate and is coated with a SiO_2 layer deposited by plasma enhanced chemical vapor deposition ("PECVD") (paragraph [0002]), which is then polished and either coated with a second SiO_2 layer or is plasma treated (paragraph [0019]). Although two SiO_2 layers are present, EP explains that fluorine diffusion out of the FSG layer was not avoided (paragraph [0047]). EP suggests that this problem can be solved (paragraphs [0021], [0048], [0063]) through the replacement of the SiO_2 protective layer, which is traditionally used, with a SiO_xN_y layer (silicon oxynitride layer) having a thickness of 10-200 nm (paragraph [0060]). A SiO_2 layer may be interleaved between the FSG layer and the silicon oxynitride layer (paragraph [0030]). The SiO_2 layer is preferably polished before being coated with the oxynitride layer. This SiO_2 layer has a thickness of 0-2000 nm (paragraph [0060]) and does not have a protecting role, but is rather used for "gap-filling, spacing and planarizing" (paragraph [0026]).

2. The Differences Between Applicant's Claimed Invention and EP

i. Claim 22

In one aspect of Applicant's claimed invention there is "[a] method for obtaining a stabilized SiO_xF_y fluorine-doped silica thin layer, comprising forming on a SiO_xF_y silicon oxyfluoride layer, a SiO_2 silica and/or a metal oxide **protective layer through ion beam-assisted vapor phase deposition . . . wherein the beam of positive ions is formed with an ion gun**." Claim 22 (emphasis added); *see also* claim 47. Ion beam-assisted vapor phase deposition involves bombarding the layer being deposited with a beam of positive ions.

By comparison, EP discloses the use of PECVD to deposit a silicon dioxide layer onto the FSG (SiO_xF_y) layer. Again, PECVD involves the use of plasma gas to perform the deposition process. That is to say, EP fails to disclose or even suggest using Applicant's claimed "ion beam-assisted vapor phase deposition" process to deposit the silicon dioxide onto the FSG layer—much less the use of an ion gun to do so. If anything, the differences between PECVD and Applicant's claimed ion beam-assisted vapor phase deposition suggests that the cited EP reference actually teaches away from Applicant's claimed invention.

Further, EP also fails to disclose or suggest Applicant's claimed "SiO_2 silica and/or a metal oxide **protective layer**" which is formed on the SiO_xF_y silicon oxyfluoride layer. Rather, the SiO_2 cap layer (which is deposited between the FSG layer and a silicon oxynitride layer) in EP is used for "gap-filling, spacing and planarizing" (paragraph [0026]) and not as a protective layer. In fact, EP explains that fluorine diffusion out of the FSG layer was not prevented by the SiO_2 cap layer (paragraph [0047])—*i.e.*, it was not a protective layer.

ii. Claim 47

Claim 47 concerns "[a] stabilized SiOxFy fluorine-doped silica thin layer coated with a silica and/or metal oxide protective layer, wherein said protective layer has been obtained through ion beam-assisted vapor phase deposition...wherein the beam of positive ions is formed with an ion gun."

It is well-settled that structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over the prior art, especially where the product can only be defined by the process steps by which the product is made, or where the manufacturing process steps would be expected to impart distinctive structural characteristics to the final product. *See, e.g., In re Garnero*, 412 F.2d 276, 279, 162 USPQ 221, 223 (CCPA 1979). In the present case, the structure of the protective layer in claim 47 cannot be easily defined other than by reciting the steps of the process by which said layer is made.

With this framework in mind, Applicant respectfully notes that when compared to a product bearing a silicon oxyfluoride layer coated with a SiO_2 layer deposited by PECVD (such as the one described in paragraph 39 of EP), a product having a protective layer deposited by vapor phase deposition under ion assistance or by cathodic sputtering/oxidation (as claimed by Applicant in claim 47) is more compact, denser and harder due to the bombardment with ions in the first case, and with high-speed, high-energy atoms in the second case. Therefore, a person of ordinary skill in the art is able to discover that a SiO_2 and/or metal oxide layer has been deposited through a process according to claim 22 rather than the process exposed in EP. Due to compression, the protective layer according to applicant's claimed invention exhibits, *e.g.*, a higher refractive index than a layer that would have been deposited according to the process of EP.

Another structural feature induced by the deposition process of the protective layer according to Applicant's claimed invention is the stabilization of the underlying silicon oxyfluoride layer. The latter in particular exhibits a refractive index which is stable over time. This feature would not be obtained if the SiO_2 and/or metal oxide protective layer had been deposited without ion assistance or without sputtering. This stability feature of the material can be easily recorded by those of ordinary skill in the art.

The product according to claim 47 exhibits distinctive structural characteristics capable of distinguishing it from previously known products. This is precisely the reason why layers having been deposited through Applicant's process represents an efficient barrier against out diffusion of fluorinated substances, contrary to SiO_2 layers prepared according to EP.

3. Conclusions Regarding the Anticipation Rejection

Although EP may suggest depositing a SiO_2 layer onto a silicon oxyfluoride layer, it simply does not teach or suggest doing so with an ion beam-assisted vapor phase deposition process—much less where the beam of positive ions is formed with an ion gun. Rather, EP discloses the use of a plasma vapor phase (*i.e.*, PECVD) to deposit its SiO_2 layer onto a silicon oxyfluoride layer. Further, the EP SiO_2 layer is not a protective layer, as it is used simply for "gap-filling, spacing and planarizing." Additionally, there are several structural features of the claimed "stabilized SiOxFy fluorine-doped silica thin layer coated with a silica and/or metal oxide protective layer" of claim 47 that are simply not disclosed or suggested by EP.

For at least these reasons, Applicant respectfully requests that the current anticipation rejection be withdrawn, as EP fails to disclose every aspect of Applicant's claimed invention.

E. The Obviousness Rejection Is Overcome

1. The claimed invention is patentable over EP

Claims 22, 26, and 27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over EP. In order to maintain this obviousness rejection, the Examiner bears the burden of showing that every element of the claimed invention is disclosed or suggested by the cited EP reference. MPEP § 2143.03.

Applicant disagrees with this rejection. The arguments made above equally apply to this obviousness rejection and are therefore incorporated by reference. These arguments confirm that EP fails to disclose or suggest at least Applicant's claimed "ion beam-assisted vapor phase deposition . . . wherein the beam of positive ions is formed with an ion gun." Applicant also provides the following arguments as additional support for removal of the obviousness rejection.

EP discloses the use of plasma gas to perform the deposition of the SiO_2 layer onto the silicon oxyfluoride layer. By comparison, Applicant's claimed invention involves the use of ion beams to perform the deposition process. That is to say, a person of ordinary skill in the art, upon reading EP, would be led in a direction (use of plasma vapor) that is divergent from the path claimed by Applicant (use of ion beams). Additionally, a person of ordinary skill would be led in a direction divergent from the path that was taken by the applicant, because EP teaches that a SiO_2 layer cannot be used as a protective layer capable of preventing the diffusion of fluorinated substances. *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) ("A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant."). Such evidence is an indication of non-obviousness. *In re Peterson*, 315 F.3d 1325, 1331 (Fed. Cir. 2003) ("[A]n applicant may

rebut a *prima facie* case of obviousness by showing that the prior art teaches away from the claimed invention in any material respect.").

Second, there does not appear to be an apparent reason to modify EP "in a fashion claimed by" Applicant. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. slip op. at 14. For instance, there does not appear to be any reason to abandon the plasma vapor deposition techniques in EP for Applicant's claimed ion beam-assisted deposition techniques. Further, Applicant is at a loss to find an apparent reason in EP to form a beam of positive ions with an ion gun. This is especially true given the substantial differences between the use of plasma vapors and ion beams in deposition techniques. Bombarding the layer with an ion beam while it is being deposited is not contemplated in EP.

In view of the above, the current claims are not rendered obvious by the EP reference. Applicants, therefore, request the withdrawal of this rejection.

2. The claimed invention is patentable over EP in view of INH and Machol in view of INH in view of EP

Claims 30-32 are rejected under 35 U.S.C. § 103(a) as being obvious over EP in view of Lee *et al.* (*Surface and Coatings Technology*, 128-129:280-285, 2000) (referred to as "INH"). INH allegedly discloses a method for producing a SiO_xF_y film. Claims 22-25, 28, 29, 33-39, 44-52, 54-60, and 65-67 are also rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent 5,719,705 to Machol (referred to as Machol) in view of EP and INH. Machol allegedly discloses an antireflective coating on a transparent substrate such as an ophthalmic lens.

Applicant disagrees with these rejections. It is important to note that these rejections both rely on the teachings of EP for deposition process. In view of this, Applicant respectfully notes that all of the arguments made above apply to these obviousness rejections and are therefore incorporated by reference. These arguments confirm that EP fails to disclose or

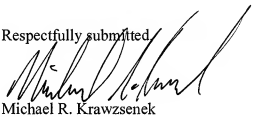
suggest at least Applicant's claimed "ion beam-assisted vapor phase deposition . . . wherein the beam of positive ions is formed with an ion gun."

For at least the above, the current claims are not rendered obvious by the EP in view of INH or Machol in view of EP and INH. Applicant requests that these rejections be withdrawn.

F. Conclusion

Applicant believes that this is a full and complete response to the Office Action mailed June 28, 2007. A Notice of Allowance is requested. Should the Examiner have any questions, comments, or suggestions relating to this case, the Examiner is invited to contact Applicant's representative at (512) 536-3020.

Respectfully submitted,



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